AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT NO 65

7 February to 18 May 1989

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Reason for Tank Opening

To install resistors on the column and tube throughout the 14UD.

Preamble

"All's well" would appear to be the best way to describe the period 6 Feb to 2 Apr 89. Experimenters did not have one disparaging remark about the 14UD during this period, which is a fitting farewell to Corona Points.

Tank Opening 4 April

The initial inspection showed up black marks around the unused casting cover pin in Unit 22. The LE appears very dusty compared to the HE end. Spark mark distribution around the terminal can be seen on the diagram No 1.

In view of the large amount of work to be done on the accelerator installing resistors, we wiped down the column using chamois and our water detergent solution to remove as much dust as possible.

Post

Broken ceramic in post number 2 in Unit 11 was due, we believe, to running with high, 92.7 PSIA tank pressure. The spark damage to spark gap electrode in Unit 2 is an old wound that we had shorted out. Both posts were replaced with reconditioned ones. We noticed that post number 2 in Unit 17 had lost most of its conducting araldite from its end joint. It was decided to leave it for this opening.

Chains

Elongation and cracking around the pin holes in the metal pellets, prompted us to be safe rather than 'sorry' and install a new chain in position number 3. The replaced chain was in the machine from 9 Feb 84 until 28 Apr 89 with a total of 23,670 hours running.

Preparations for Resistor Installation

Before resistors could be installed, we had to clean all spark gap flanges on the tube and post. This was done by using scouring pads (plain) and a water with 30% acetone solution.

To most conveniently accommodate the tube resistors, we moved the top stringer in every second unit 180° around which put a hem on the post nearest the shorting rod path.

The pneumatic tube going to the HE foil stripper was rerouted through the second casting feed through flange. This gave us adequate clearance for the post resistors in the HE end.

A notch had to be machined into the cover plate in Unit 19 to clear the bottom tube resistor.

Resistor Bolt on Time

The actual clamping on of resistors was a straightforward operation after the positioning of the resistors had been established.

The ease of installation of resistors, would be improved if half the resistors had left hand clamps and the rest right handed. Then the clamping screw would always face upward making access for allen keys easy.

Post Resistors LE end

In the LE end of the machine, all post resistors were mounted on post number 2 in all units. See diagram 2. The value of each resistor of repair is 982 Meg ohms, except for the 3 gaps either side of a casting where an 8 gap tube section is located. The value of these resistors is 575 meg ohms.

Post Resistors HE end

Mounting of resistors in the HE end is the same as for the LE end with the exception that all resistors are on post number 4. This is to keep the resistors away from chains as much as possible.

Tube Resistors

Value of all tube resistors is 300 meg ohms. There are 22 per 11 gap and 16 per 8 gap tube.

Sheet metal tags are screwed to the tube and flanges using the former corona point attaching position. The resistors are then clamped to this tag.

Tube resistors that are located in castings have had their mounting tags bend upward at 30° to the horizontal. This gives more clearance between casting bore and loop of wire connecting resistor ends.

At either end of the HE tube, we have an 8 gap tube section that has to be voltage matched to 3 gaps on the post. To do this, we have halved the gradient across the 8 gap tube by replacing every second resistor with an aluminium rod.

Unit 19

We have to distribute 12 column gaps over 26 tube gaps. It was done by having half gradient across the four central gaps in the 11 gap tube section directly above the HE stripper housing.

Electrical Connections of Resistors

The leads used to connect all the resistors were plastic insulated and measured 90mm between the banana plug ends. The leads we had ordered were meant to be 75mm long but due to ambiguity of over what portion this distance was to be measured, we had to make do with the longer leads.

A jointing compound designed to be used for aluminium to aluminium joints was used on all resistor electrical connections. It was hoped that this would prevent oxidation of the gold banana plug to the bore of the aluminium nut and avoid roughening of the aluminium surface when installing the banana plug.

Cleaning

The column was blown down with nitrogen gas before the rings were put on in each unit. The top and bottom of all castings were wiped with chamois and our water detergent solution. After rings fitted, the column was wiped down. During the tank opening the terminal was not opened.

Charging Test

With the platform parked above unit 1 and no shorting strap on the terminal, we tried to run the voltage accelerator up. First mistake was leaving the platform power cable dangling down the inside of the tank. This was fouling the GVM and being attracted to the terminal causing sparks.

With all the lights off in the tower, we ran the terminal up to 1.5 MV without any sign of sparking. We took this to mean all the resistors had been connected. We discovered that if you go to 1.6 MV terminal in air you get a very loud spark.

We did out normal charging test, with the terminal shorted to ground and with the chains running, chain No 1 would not go above 16-16 μA as in previous openings. Chains 2 and 3 OK.

Doors closed 16.30, 27 April 89.

Initial Running after Closing

With tank pressure at 85.0 PSIA there was sparking showing on the NMR trace as soon as volts were run. The terminal reached 10.0 MV with many sparks. With groups of 5 units live we had glitching show on NMR trace at 3.6 MV terminal. This appears common for all units and we were only able to get to .90 MV/unit.

Gas taken out 1 May 89.

First Inspection

The cause of sparking problems was obvious. The resistor leads were too long and flexible. They were attracted to one another and touched. When the leads touched the PVC insulation sparked away and deposited itself throughout the 14UD.

Correcting the Leads

It is ironic that these commercial leads were used to save us the effort of manufacturing 1500 leads ourselves. Because the new plugs and cable to make the new leads were several weeks away, we had no option but salvage the existing leads.

To salvage the leads the procedure was strip the insulation from the cable, taking care not to break any wire strands, remove one plug and the insulation on the plugs. Cut the cable to the new length and soft solder both banana plugs to the cable. This had to be done to 1500 leads.

By 8 May 89 all resistor leads had been modified and installed.

Electrical Checks

To make certain no leads had been left out, we put 10 KV from stringer to stringer looking for breakdown. None were found.

LE Metering

There was an intermittency on the meter which was due to support cup on the metering cable shorting to ground. This was repaired.

Doors were closed 5.30 pm on 8 May 89.

Low Energy Casting

June 89

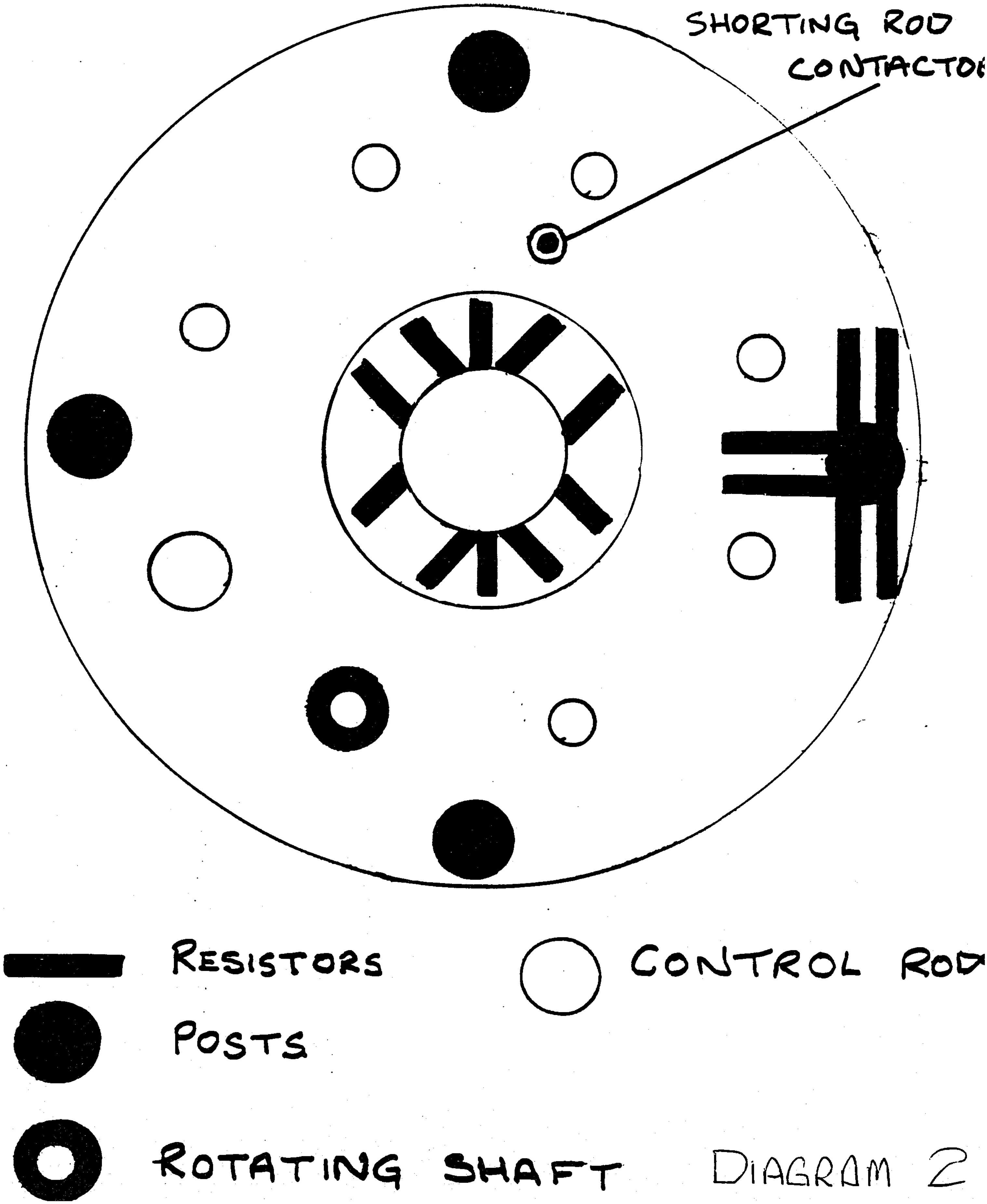
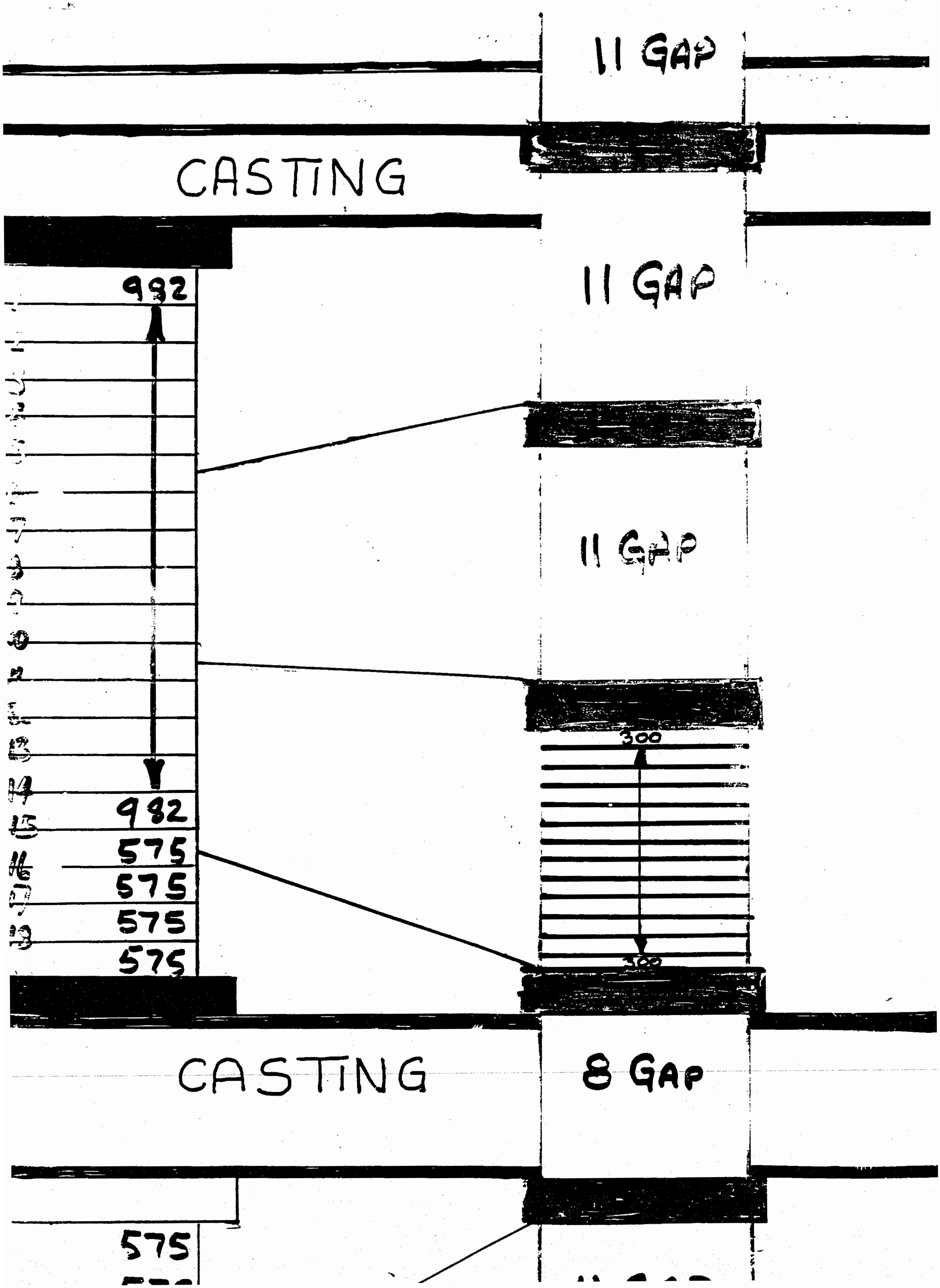


Diagram 2


11 GAP
CASTING
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CASTING
8 GAP
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DISTRIBUTION OF SPARK MARKS